

# FISH MANAGEMENT REPORT 121

## A CREEL CENSUS ON SHAWANO LAKE, 1977-78, WITH EMPHASIS ON NORTHERN PIKE

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### ABSTRACT

In an attempt to assess the effects of liberal regulations on northern pike, a stratified random creel census was conducted on Shawano Lake in Shawano County from 6 June 1977 to 5 June 1978.

Angling pressure during the survey year was estimated at 452,187 hours, or 73.2 hours/acre. (The lake is 6,178 acres.) Over 61% of the annual angling pressure was ice fishing. The annual harvest rate was 1.09 fish/hour. Panfish comprised 89% of the total annual harvest.

Anglers harvested an estimated 43,560 northern pike or 7.1 northern pike/acre during the year. Liberal regulations on northern pike contribute little to the high northern pike harvest at Shawano Lake.

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## INTRODUCTION

In an effort to reduce the northern pike population of Shawano Lake, liberal angling regulations were instituted in 1956. Since then, there has been a daily bag limit of 25 and no closed season or size limits on northern pike. This investigation tried to determine the effects of these liberal angling regulations.

With an area of 6,178 acres, Shawano Lake is one of the larger lakes in Wisconsin. The close proximity of the Fox River Valley (Fig. 1) makes Shawano Lake a popular lake for all forms of water recreation. Private dwellings and resorts dot 16 of the 18 miles of the lake's shoreline.

Shawano Lake is a hard water drainage lake with slightly alkaline, clear water of moderate transparency. It has a maximum depth of 40 ft and average depth of 6 ft. Over 93% of the lake is less than 20 ft deep. Bottom types are approximately 50% muck and 50% sand. Most of the expansive littoral areas are heavily vegetated, and the lush macrophyte growth causes problems for some summer lake users.

There are nine inlets to Shawano Lake. Washington Creek drains Loon and Washington lakes and Pickereel Creek drains White Clay Lake and the Mud Lake Marsh. The remaining inlets are small and most flow only seasonally. The outlet of Shawano Lake is tributary to the Wolf River. A dam on the river raises the water level of Shawano Lake 1.0-1.5 ft.

Public access to Shawano Lake is provided by five boat ramps with parking, numerous launching sites without parking, navigation through the outlet, and from Washington Lake.

Twenty-seven species of fish are known to be present in Shawano Lake (Table 1). Dominant game fish are northern pike, walleyes, and largemouth bass. The panfish population is dominated by bluegills, pumpkinseeds, black crappies, and yellow perch.

Records of past fish management on Shawano Lake are sketchy. Northern pike and walleye eggs were taken for propagation in most years from 1944-70. Over 9 million walleye fry were stocked from 1965-70 as plantbacks from egg-taking operations.

## METHODS

A stratified random creel census was conducted on Shawano Lake from 6 June 1977 to 5 June 1978. This census was based on that described by Lambou (1961). Each census day was divided into two 8-hour shifts: 6 a.m. to 2 p.m. and 2 p.m. to 10 p.m. One shift in each weekend day and 30% of the weekday shifts were sampled. Holidays were treated as weekend days. Weekend shifts and weekday shifts were selected randomly.

A complete count of all anglers on the lake was made at the beginning and end of each census shift. In addition, one or more angler counts were made during the shift. The average of the counts was used as the number of anglers fishing at all times during the shift. The size of the lake prohibited more frequent angler counts.

Angler interviews were conducted between counts. These interviews obtained information on: number, length, and species of fish caught and harvested, size of party, length of trip, angler residence, species sought by angler, and fishing method(s) used.

Angling pressure was estimated by month. This was further separated into weekday pressure and weekend and holiday angling pressure. November and April were also separated into ice fishing and open water fishing.

Based on information from the angler interviews, harvest rates for each species were obtained by dividing the number of fish harvested by the total number of hours fished. The total harvest by species was estimated by multiplying the harvest-rate of each species x the estimated total fishing pressure. Harvest rates were calculated for each month from complete and incomplete fishing trips.

Fyke nets were used to sample spawning northern pike at ice-out in 1978. Fish were sexed and measured to the nearest 1/10 of an inch. Scales from fish representative of sex and length were aged to obtain an index of relative growth. Northern pike total annual mortality rates were calculated as the slope of age vs log of fish numbers in each age.

## RESULTS AND DISCUSSION

### Angling Pressure

Shawano Lake anglers fished an estimated total of 452,187 hours or 73.2 hours/acre during the creel census period (Table 2). This does not include anglers fishing between 10 p.m. and 6 a.m. Weekday pressure exceeded weekend pressure in all months except January, February, and March. Weekday pressure was 54.8% of the annual fishing pressure on Shawano Lake.

Ice anglers fished 277,490 hours, or 44.8 hours/acre, which comprised 61.2% of the total annual fishing pressure. December, January, and February were the months of highest fishing pressure. Extensive publicity, winter layoffs by local industries, and frequent fishing contests contributed to the higher winter fishing pressure. Fishing pressure was lowest in November and April because unsafe ice during freeze-up and ice-out limited angling during these months.

A total of 55,502 ice fishing trips and 43,669 open water trips were made. Based on completed trips, the average ice fishing trip was 4.99 hours while open water trips averaged 4.0 hours. Ice anglers used shanties extensively for comfort, and many anglers spent the whole day on the ice. During open water fishing, many anglers who were interviewed had been on the water from 4-8 hours.

Angling pressure on Shawano Lake was comparable to other Wisconsin lakes (Table 3).

## Harvest

Anglers harvested an estimated 492,366 fish, or 79.7 fish/acre, from Shawano Lake during the year the creel census was conducted. Fish caught and returned to the water were not included in this estimate.

The total annual harvest rate of 1.09 fish/hour can be divided into 0.97 panfish/hour and 0.12 game fish/hour. May had the highest monthly harvest rate at 1.92 fish/hour and December was the lowest at 0.33 fish/hour (Table 4). Harvest rates do not reflect that some anglers were fishing for a particular species using methods that may have precluded catching other species.

Nine major species contributed to the harvest during the creel census (Table 5). In addition to those listed, 1 muskellunge and 2 smallmouth bass were observed in angler interviews. Black, brown, and yellow bullheads were combined as bullheads in this report.

Panfish contributed 89% of the total annual harvest with bluegills being the most numerous. Harvest of individual species of panfish varied throughout the year (Fig. 2).

Northern pike constituted 82% of the game fish catch with 43,560 or 7.1/acre harvested. The walleye harvest of 1.2/acre was 4 times greater than the largemouth bass harvest at 0.3/acre. (A number of Shawano Lake anglers fished walleyes at night after the creel census hours, so the walleye harvest may have been substantially higher than indicated.) In view of the excellent largemouth bass population found in various surveys, the largemouth bass harvest seemed quite low.

Length frequency tables of the eight major species harvested are found in Appendix A. Data for bullheads was insufficient to construct a length frequency table.

Ice fishing accounted for 75% of the northern pike and black crappie harvest. About half the walleyes and 41% of the bluegills were taken by ice fishing.

## Angler Characteristics

During the creel census, 3,645 angler interviews were conducted. On a monthly basis, males accounted for at least 87% of Shawano Lake anglers (Table 6). A minimum of 64.8% of the anglers each month were males between the ages of 16 and 64.

Distances anglers traveled to fish Shawano Lake were categorized into district geographic areas (Fig. 3). Local anglers included those from 0-29 miles. Over 61% of the anglers interviewed traveled more than 30 miles to fish Shawano Lake. Most ice anglers were locals, but most open water anglers traveled over 30 miles to fish (Fig. 3). About 95% of those anglers traveling 30-100 miles were from the Fox River Valley (Green Bay to Fond du Lac). Approximately 80% of the resident anglers from over 100 miles away were from southeastern Wisconsin. Most nonresidents were from Illinois; however anglers from 14 other states and 1 foreign country were interviewed.

### Northern Pike Data

An estimated 43,560 northern pike, or 7.1/acre, were harvested during the year that the creel census was conducted. This was one of the highest reported in Wisconsin (Table 7).

Harvest rates varied from 0.01 fish/hour in August to 0.17 fish/hour in April. The monthly harvest ranged from 198 fish in November to 9,988 fish in February. The ice angling harvest rate was 2.5 times higher than in open water harvest rates. Snow (1878a) found similar results in Murphy Flowage when comparing ice angling harvest rates to open water harvest rates.

The daily bag limit of 25 northerns seemed to have little direct effect on the harvest. Of the 3,645 angler interviews, only 16 anglers had more than 5 northern pike when contacted and no angler had more than 10. However, the opportunity to take home 25 northerns a day contributed to the angling pressure. Snow (1982) calculated that a 5-fish daily bag limit on Murphy Flowage would have reduced the northern pike harvest by 0.5% in summer and 1.5% in winter.

March and April accounted for 12.3% of the annual northern pike harvest. If this harvest had been precluded by season closure as in most other state waters, the annual harvest still would have exceeded 6 fish/acre. Only 3 of the 423 anglers interviewed in March and April had more than 5 northerns when interviewed. Snow (1982) found a maximum of 7% of the northern pike harvest from Murphy Flowage occurred during the normal closed season.

The average length for northerns harvested in March and April did not exceed those of the other months of ice fishing. A fyke net sample of 870 adults taken at ice-out in 1978 averaged 19.8 inches. The average length in the March and April harvest was 18.9 inches (Table 8). Thus, anglers were not harvesting a disproportionate share of larger fish in prespawning and spawning concentrations.

The total annual mortality rate for northern pike age III-IX was 54% ( $r = -0.8537$ ). Compared to other Wisconsin lakes (Table 9), the total mortality rate for Shawano Lake was below average. Groebner (1964) found little relationship between total fishing pressure and total mortality of northern pike. Snow and Beard (1972) concluded that little relationship existed between northern pike exploitation and total mortality in Bucks Lake.

Growth of Shawano Lake northern pike was average for northern Wisconsin until age IV. Over age IV, the growth rate was below average (Table 10). Northern pike enter the Shawano Lake fishery at age II with the bulk of the harvest composed of age III and IV fish.

The high northern pike harvest cannot be attributed solely to the liberal regulations. It was more a product of a probable large northern pike population and relatively high winter fishing pressure. Winter weather and ice conditions determine winter angling pressure, and this in turn determines the annual northern pike harvest on Shawano Lake.

## CONCLUSION

Angling pressure, particularly ice fishing, was substantial on Shawano Lake. A diversity of species and relatively high catch rates made Shawano Lake attractive to anglers.

The annual harvest of 7 northern pike/acre did not appear to have a detrimental effect on the northern population. Northern pike mortality rates were not excessive compared to other Wisconsin waters, especially when the high harvest was considered.

Liberal regulations on northern pike contribute little to the high northern pike harvest. Few anglers kept more than 5 northerns a day and less than 1/8 of the northern harvest occurred in March and April. The high northern harvest was the result of high winter fishing pressure.

TABLE 1. Known fish species in Shawano Lake.

Common Name	Scientific Name
Muskellunge	<u>Esox masquinongy</u>
Northern pike	<u>Esox lucius</u>
Yellow perch	<u>Perca flavescens</u>
Walleye	<u>Stizostedion vitreum vitreum</u>
Black crapple	<u>Pomoxis nigromaculatus</u>
Bluegill	<u>Lepomis macrochirus</u>
Largemouth bass	<u>Micropterus salmoides</u>
Pumpkinseed	<u>Lepomis gibbosus</u>
Rock bass	<u>Ambloplites rupestris</u>
Smallmouth bass	<u>Micropterus dolomieu</u>
Shorthead redhorse	<u>Moxostoma macrolepidotum</u>
White sucker	<u>Catostomus commersoni</u>
Longnose gar	<u>Lepisosteus osseus</u>
Bowfin	<u>Amia calva</u>
Central mudminnow	<u>Umbra limi</u>
Yellow bullhead	<u>Ictalurus natalis</u>
Black bullhead	<u>Ictalurus melas</u>
Brown bullhead	<u>Ictalurus nebulosus</u>
Bluntnose minnow	<u>Pimephales notatus</u>
Brook silverside	<u>Labidesthes sicculus</u>
Common carp	<u>Cyprinus carpio</u>
Common shiner	<u>Notropis cornutus</u>
Fathead minnow	<u>Pimephales promelas</u>
Golden shiner	<u>Notemigonus crysoleucas</u>
Johnny darter	<u>Etheostoma nigrum</u>
Lake chubsucker	<u>Erimyzon sucetta</u>
Spottail shiner	<u>Notropis hudsonius</u>

TABLE 2. Estimated angling pressure on Shawano Lake, June 1977 to June 1978.

Month	Angling Pressure (Hours)			Hours/Acre	Percent of Annual Total
	Weekday	Weekend	Total		
Jun	17,708	12,260	29,968	4.85	6.6
Jul	34,929	15,975	50,904	8.24	11.3
Aug	18,641	10,245	28,886	4.68	6.4
Sep	12,040	7,618	19,658	3.18	4.3
Oct	4,872	2,744	7,616	1.23	1.7
Nov					
Open Water	776	222	998	0.16	0.2
Ice	270	194	464	0.08	0.1
Dec	56,220	12,555	68,775	11.13	15.2
Jan	35,204	54,195	89,399	14.47	19.8
Feb	28,093	55,159	83,252	13.48	18.4
Mar	12,779	18,759	31,538	5.10	7.0
Apr					
Ice	2,740	1,323	4,063	0.66	0.9
Open Water	1,662	1,046	2,708	0.44	0.6
May	22,050	11,908	33,958	5.50	7.5
Total	247,984	204,203	452,187	73.20	100.0

TABLE 3. Fishing pressure and harvest rates on several Wisconsin lakes.

Lake, County, and No. Years	Acreage	Angler Hours/Acre	Fish Harvest/Hour	Reference
Shawano, Shawano Co. (1 year)	6,178	73	1.09	Current study
Murphy Flowage, Rusk Co. (15-year Avg.)	180	74	1.88	Snow (1978)
Bucks, Rusk Co.	83	20	1.0	Snow and Beard (1972)
Escanaba, Vilas Co. (24-year Avg.)	293	65	0.84	Kempinger et al. (1975)
Noquebay, Marinette Co. (1 summer only) (1 winter only)	2,409	34 13	1.28 0.65	Thuemler (1981) T. Thuemler (unpubl. data)
Fox, Dodge Co. (1 year)	2,625	268	1.03	J. Congdon (unpubl. data)
Beaver Dam, Dodge Co. (1 year)	6,542	25	1.25	J. Congdon (unpubl. data)
Devils Lake, Sauk Co. (2-year Avg.)	379	106	0.77	Brynnildson et al. (1970)
Black Oak, Vilas Co. (1 summer only)	584	19	0.74	McKnight and Serns (1974)
Laura, Vilas Co. (1 summer only)	599	20	0.58	McKnight and Serns (1974)
Stormy, Vilas Co. (1 summer only)	522	16	0.62	McKnight and Serns (1974)

TABLE 4. Shawano Lake angler harvest rates from June 1977 to June 1978 (fish/hour).

Month	Largemouth Bass	Bluegill	Pumpkin- seed	Black Crappie	Yellow Perch	Rock Bass	Bull- head	Northern Pike	Walleye	Total*
May	0.01	0.50	0.68	0.29	0.08	0.20	0.00	0.13	0.04	1.92
Jun	0.01	0.81	0.26	0.23	0.26	0.07	0.00	0.04	0.03	1.03
Jul	0.01	0.86	0.12	0.11	0.44	0.11	0.00	0.06	0.02	1.73
Aug	0.00	0.58	0.28	0.06	0.35	0.07	0.02	0.01	0.00	1.36
Sep	0.01	0.26	0.14	0.02	0.32	0.03	0.01	0.02	0.01	0.82
Oct	0.03	0.13	0.01	0.02	1.05	0.00	0.00	0.08	0.01	1.33
Nov	0.02	0.04	0.04	0.06	0.52	0.52	0.00	0.14	0.04	0.85
Dec	0.00	0.14	0.00	0.02	0.02	0.00	0.00	0.14	0.02	0.33
Jan	0.00	0.20	0.00	0.22	0.04	0.01	0.00	0.10	0.02	0.59
Feb	0.00	0.33	0.01	0.41	0.09	0.00	0.00	0.12	0.00	0.97
Mar	--	0.75	0.04	0.69	0.14	0.01	0.00	0.14	--	1.75
Apr	--	0.67	0.07	0.23	0.28	0.05	0.00	0.17	--	1.46
Annual**	0.005	0.42	0.11	0.23	0.23	0.04	0.00	0.10	0.02	1.09

\*Columns may not add to total because of rounding.

\*\*Annual harvest rates were calculated by dividing the estimated annual harvest by the estimated annual angling hours. Largemouth bass and walleye annual harvested rates excluded March and April angling hours.



TABLE 5. Estimated harvest from Shawano Lake, June 1977 to June 1978.

Month	Largemouth Bass	Bluegill	Pumpkin-seed	Black Crappie	Yellow Perch	Rock Bass	Bull-head	Northern Pike	Walleye	Total
May	447	16,857	22,974	9,951	2,555	6,630	53	4,363	1,409	65,239
Jun	308	24,158	7,766	6,989	7,696	2,201	0	1,064	819	50,901
Jul	620	43,972	6,334	5,390	22,217	5,337	68	2,808	1,214	87,970
Aug	127	16,650	7,936	1,674	9,957	1,876	519	375	64	39,178
Sep	192	5,030	2,762	416	6,240	638	253	381	126	16,038
Oct	205	980	75	152	8,019	6	0	640	44	10,121
Nov	25	65	65	81	756	0	0	198	58	1,248
Dec	0	9,438	0	1,256	1,206	0	0	9,479	1,176	22,555
Jan	0	17,977	0	19,481	3,550	905	0	8,901	2,139	52,953
Feb	83	27,487	1,032	34,314	7,474	55	55	9,988	365	80,853
Mar	*	23,517	1,255	21,615	4,354	342	75	4,246	*	55,404
Apr	*	4,528	471	1,587	1,888	325	0	1,117	*	9,916
Total	1,907	190,659	50,670	102,906	75,912	18,315	1,023	43,560	7,414	492,336
Total Fish/Acre	0.3	30.9	8.2	16.7	12.3	3.0	0.2	7.1	1.2	79.7
% of Total Harvest	0.4	38.7	10.3	20.9	15.4	3.7	0.2	8.8	1.5	100.0

\*Season closed.

TABLE 6. Sex and age characteristics of Shawano Lake anglers interviewed, from June 1977 to June 1978.

Month	Number of Interviews	Males				Females			
		Percent Males	Percent Under Age 16	Percent Ages 16-64	Percent Over Age 64	Percent Females	Percent Under Age 16	Percent Ages 16-64	Percent Over Age 64
May	364	87.0	13.3	64.8	8.9	13.0	1.6	9.2	2.2
Jun	525	87.6	5.9	73.4	8.3	1.3	0.0	1.1	0.1
Jul	378	99.5	20.0	73.3	5.8	0.5	0.3	0.1	0.1
Aug	369	99.6	20.8	69.0	9.8	0.4	0.0	0.3	0.1
Sep	192	99.2	14.6	77.2	7.4	0.8	0.0	0.5	0.3
Oct	146	96.8	11.5	70.6	14.7	3.2	0.0	3.2	0.0
Nov	40	98.4	3.3	80.3	14.8	1.6	0.0	1.6	0.0
Dec	275	95.9	9.8	80.0	5.7	4.1	0.0	3.8	0.3
Jan	429	90.2	12.7	71.3	6.1	9.8	1.5	8.1	0.2
Feb	404	88.5	12.8	65.2	10.5	11.5	0.7	8.8	2.0
Mar	411	93.4	8.5	71.3	13.6	6.6	1.2	4.6	0.7
Apr	112	96.4	7.3	82.7	6.4	3.6	0.0	3.6	0.0

TABLE 7. Northern pike harvest from several Wisconsin lakes.

Lake and County	Acres	Regulations	Harvest		Population		Reference
			No. Years	No./acre	No. Years	Population No. Acre	
Shawano Shawano Co.	6,178	No size limit No closed season 25 fish daily	1	7.1			Current study
Murphy Flowage, Rusk Co.	180	No size limit No closed season No daily limit	15	0.9-4.5 Avg. 2.8	15	Range 2.4-49.2 Avg. 10.9	Snow (1978)
Bucks, Rusk Co.	83	No size limit No closed season 5 fish daily	1	9.6	5	Range 12.4-49.3 Avg. 31.9	Snow and Beard (1972)
Bucks, Rusk Co.	83	18-inch size limit No closed season 5 fish daily	2	1.1	5	Range 13.3-28.0 Avg. 22.8	Snow and Beard (1972)
Escanaba, Vilas Co.	293	No size limit No closed season	6	0.5-3.2 Avg. 2.0	6	Range 0.9-4.1 Avg. 2.8	Kempinger and Carline (1978)
Escanaba,	293	22-inch size limit No closed season	9	0.1-0.7 Avg. 0.3	8	Range 2.4-7.8 Avg. 5.2	Kempinger and Carline (1978)
Noquebay, Marinette Co.	2,409	No size limit Closed Mar & Apr 5 fish daily	1 Summer 1 Winter	1.6  1.0			Thuemler (1981) T. Thuemler (unpubl. data 1982)
Fox, Dodge Co.	2,625	No size limit Closed Mar & Apr 5 fish daily	1	3.6			J Congdon (In press)
Beaver Dam, Dodge Co.	6,542	No size limit No closed season 5 fish daily	1	1.0			J. Congdon (unpubl. data 1979)
Boot Lake, Oconto Co.	263	No size limit Closed Mar & Apr 5 fish daily	1 winter	0.7			T. Thuemler (unpubl. data 1982)

TABLE 8. Length frequency comparison between fyke net sample and spring angler harvest of spawning northernns in Shawano Lake.

Length (Inches)	Fyke Net Sample (Ice-Out 1978)	Angler Harvest (March and April 1978)
11.0-11.9	2	
12.0-12.9	4	6
13.0-13.9	12	8
14.0-14.9	15	8
15.0-15.9	28	16
16.0-16.9	47	26
17.0-17.9	84	25
18.0-18.9	147	31
19.0-19.9	167	11
20.0-20.9	128	25
21.0-21.9	87	16
22.0-22.9	67	9
23.0-23.9	31	6
24.0-24.9	22	2
25.0-25.9	12	1
26.0-26.9	9	4
27.0-27.9		3
28.0-28.9		2
29.0-29.9	1	
30.0-30.9		4
31.0-31.9	1	
32.0-32.9	3	
33.0-33.9	2	
34.0-34.9		
35.0-35.9	1	
Total	870	203
Average Length	19.75	18.93

TABLE 9. Northern pike mortality rates for several Wisconsin lakes.

Lake and County	Acres	Regulations	No. Years	Mortality (%)			Reference
				Total	Natural	Angling	
Shawano, Shawano Co.	6,178	No size limit No closed season	1	54			Current study
Murphy Flowage, Rusk Co.	180	No size limit No closed season	15	47-90 Avg. 66	9-186 40	3-50 26	Snow (1978)
Bucks, Rusk Co.	83	No size limit No closed season	5	57-84 Avg. 69	36 (1 year)	21 (1 year)	Snow and Beard (1972)
Bucks, Rusk Co.	83	18-inch size limit No closed season	4	35-82 Avg. 58	33-41 (2 years)	2-3 (2 years)	Snow and Beard (1972)
Escanaba, Vilas Co.	293	No size limit No closed season	3	69-82 Avg. 76			Kempinger and Carline (1978)
Escanaba, Vilas Co.	293	22-inch size limit No closed season	2	86 & 91			Kempinger and Carline (1978)
Fox, Dodge Co.	2,625	No size limit Closed Mar & Apr	1	58 males 43 females			J. Congdon (In press)
White Potato, Oconto Co.	978	No size limit	1	69			M. Burdick (unpubl. rep. 1980)
Twin Falls, Florence Co.	682	No size limit Closed Mar & Apr	1	56			T. Thuemler (unpubl. rep. 1976)
Spread Eagle Chain, Florence Co.	460	No size limit Closed Mar & Apr	1	53			R. Helzer (unpubl. rep. 1979)

TABLE 10. Northern pike growth rates of selected Wisconsin lakes (in inches).

Lake and County	I	II	III	IV	V	Age VI	VII	VIII	IX	X	Reference
Shawano, Shawano Co.		14.9	17.2	19.9	21.2	21.8	24.8	26.5	33.9		Current study
Average of Various NW Wisconsin Lakes	10.1	14.7	17.3	19.9	22.5	24.9	27.7	27.9	29.9	36.6	H. Snow (unpubl. data)
Average of Various SE Wisconsin Lakes	16.4	18.7	22.8	25.6	27.6	31.5	34.0	37.0			Druckenmiller (1972)
Fox Lake, Dodge Co.	9.2	17.9	23.0	26.8	29.4	31.9	35.4	37.5	28.8		J. Congdon (in press)
Grandmother Flowage, Lincoln Co.		14.8	16.9	19.9	22.6	25.1	29.5	30.9			S. Serns (unpubl. rep. 1976)
Grandfather Flowage, Lincoln Co.		13.6	16.6	20.2	25.1	26.3	33.3	31.0			S. Serns (unpubl. rep. 1976)
Alice, Lincoln Co.		23.0	116.9	19.5	20.6	22.6	23.3	27.5	28.2	32.5	S. Serns (unpubl. rep. 1976)
White Potato, Oconto Co.	10.2	17.4	22.2	28.7	28.5	33.9					M. Burdick (unpubl. rep. 1980)
Twin Falls, Florence Co.		10.6	13.0	15.3	17.3	19.1	21.3	22.9			T. Thuemler (unpubl. rep. 1976)
Spread Eagle Chain, Florence Co.		13.4	15.4	18.4	23.6	29.2	31.2	33.9	42.8		R. Helzer (unpubl. rep. 1977)
Chalk Hills, Marquette Co.		11.4	13.4	16.1	19.1	21.4	24.9	27.9	27.9		T. Thuemler (unpubl. rep. 1977)
Escanaba, Vilas Co.		14.5	19.2	21.2	23.9	26.0	27.4	29.9			Kempinger and Carline (1978)

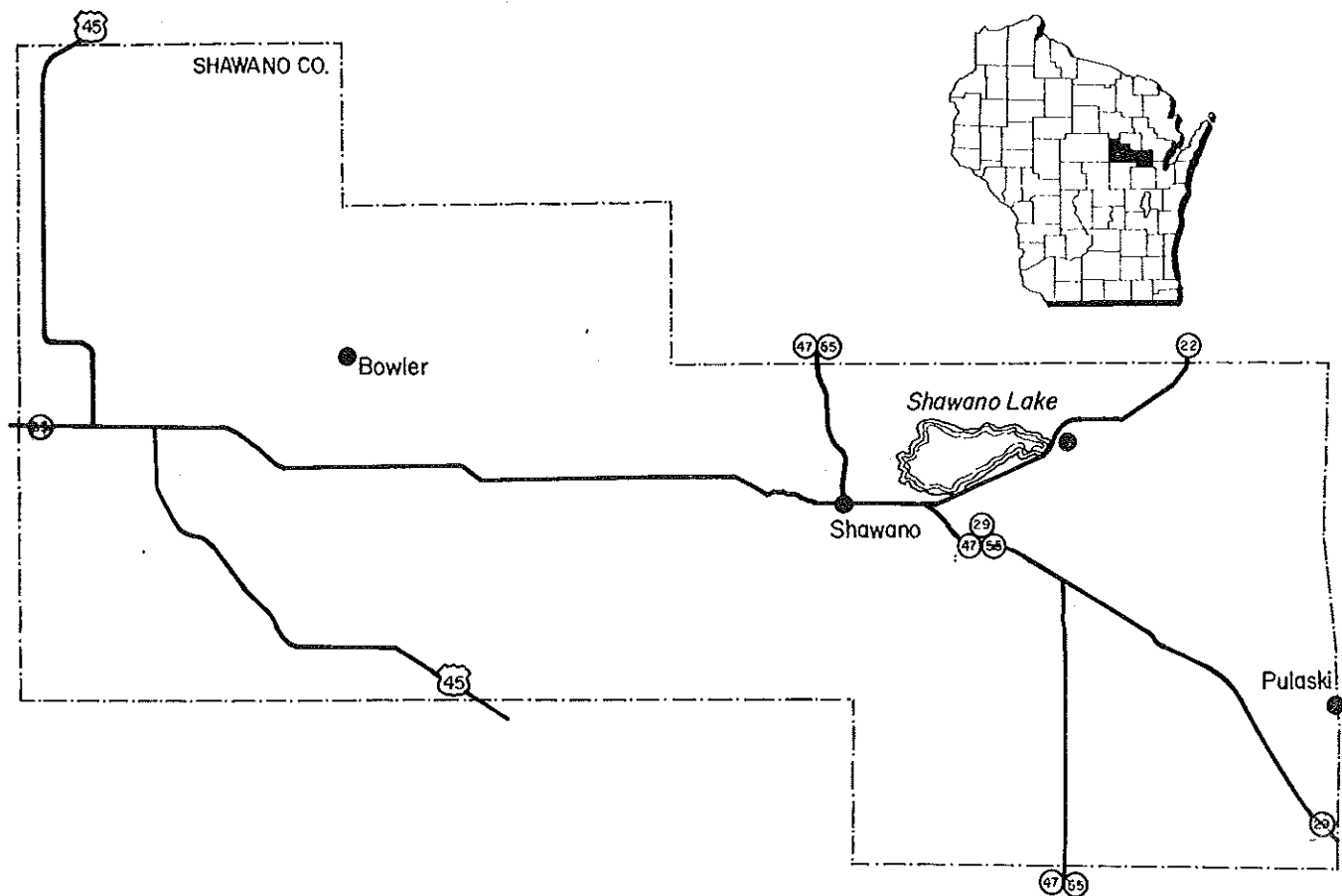


FIGURE 1. Location of Shawano Lake, Shawano County, Wisconsin.

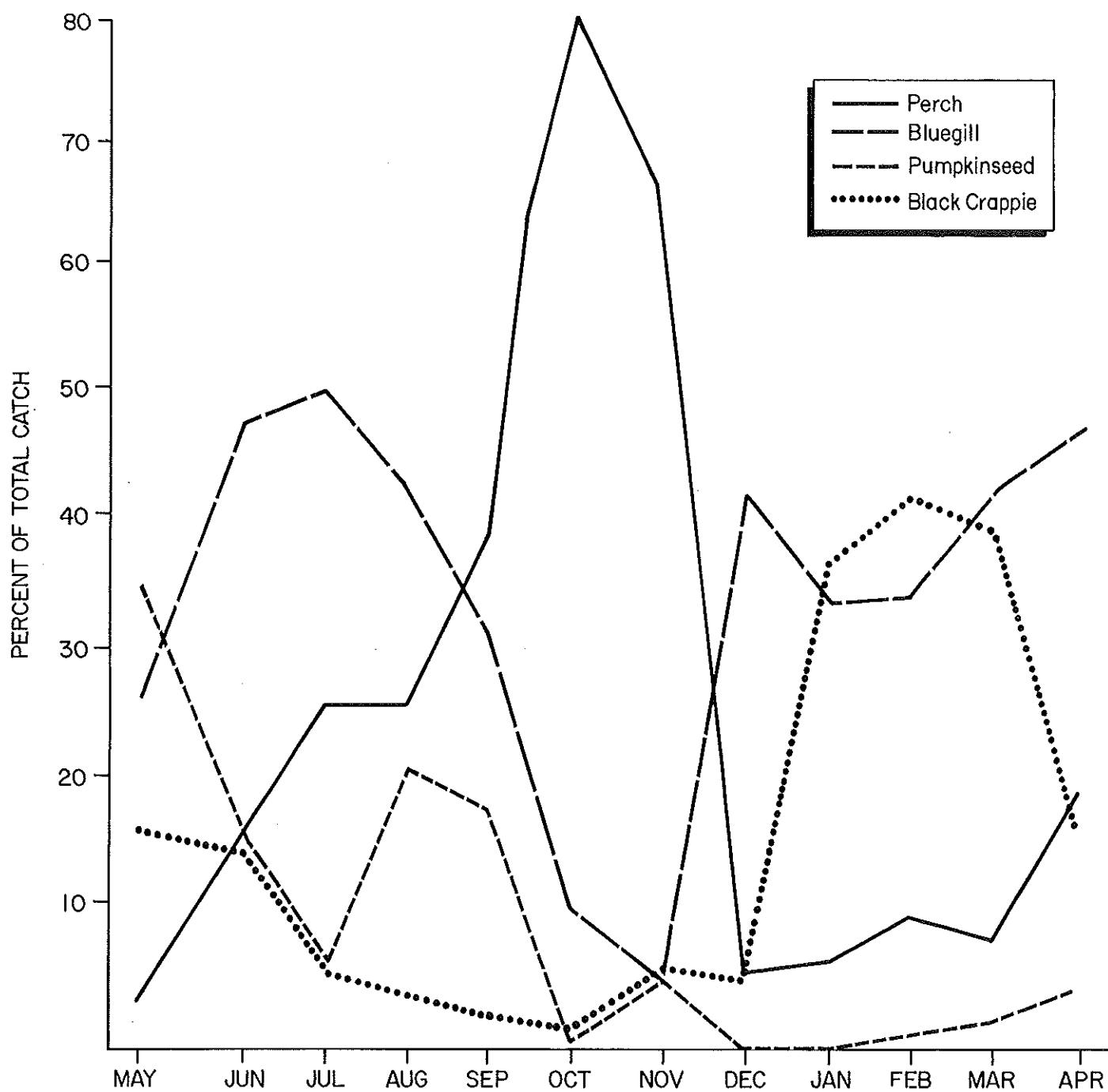


FIGURE 2. Percent of total harvest for the four most commonly harvested fish in Shawano Lake, June 1977 to June 1978.\*

\*Data for the month of May refers to May 1978.

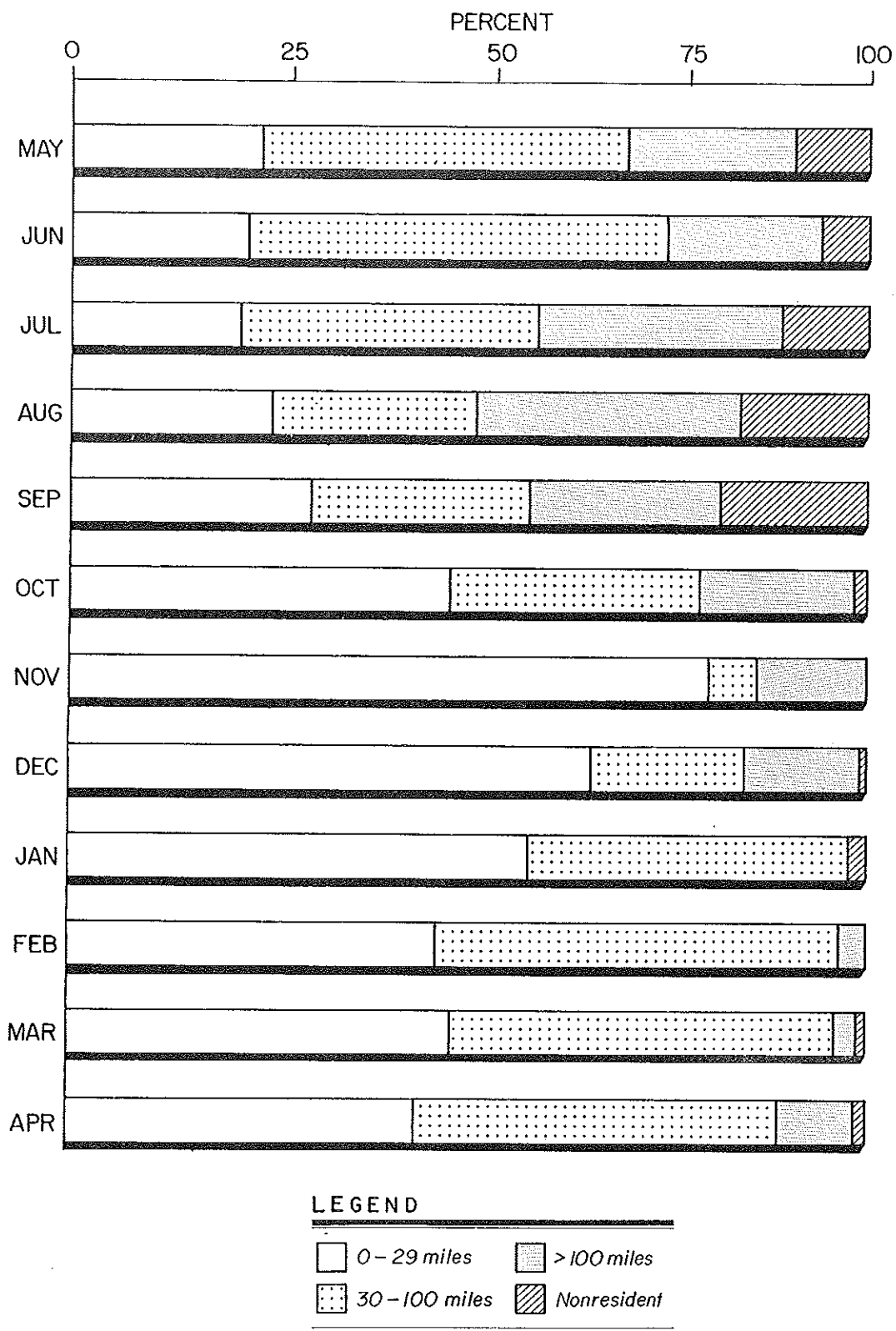


FIGURE 3. Miles anglers traveled to fish Shawano Lake, June 1977 to June 1978\*.

\*Data for the month of May refers to May 1978.

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TABLE A.1. Lenth frequency of angler-caught largemouth bass from Shawano Lake, June 1977 to June 1978.

Length (Inches)	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar*	Apr*	May
7.0-7.9		3	4	1								1
8.0-8.9	2		3	5								3
9.0-9.9	1	3	4	2	1							1
10.0-10.9	1	2	6	4	2							1
11.0-11.9	2	1	2	6	1				1			
12.0-12.9	2	2	1	3	2							2
13.0-13.9	1	2			1	1						
14.0-14.9		1		1	5				1			1
15.0-15.9	1			2	5	1	1					
16.0-16.9		1			1	1						
17.0-17.9					1	1						1
18.0-18.9					1							3
19.0-19.9									1			
Average	11.4	9.6	11.0	14.2	15.5	15.5			15.2			12.9

\*Season closed.

TABLE A.2. Length frequency of angler-caught bluegills from Shawano Lake, June 1977 to June 1978.

Length (Inches)	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
4.0-4.9	36	1	11					9	12	25	2	
5.0-5.9	267	210	187	68	3		32	124	132	265	28	29
6.0-6.9	497	539	471	187	38	6	65	129	302	563	48	178
7.0-7.9	341	183	112	55	5	2	18	21	43	111	4	57
8.0-8.9	102	38	25	9	1		1	4	18	22	2	25
9.0-9.9	15	2	4		1			3	3	4		
10.0-10.9	3							1	2	1		
11.0-11.9	1									4		
Average	6.7	6.6	6.5	6.5	6.6	6.8	6.5	6.2	6.4	6.0	6.2	6.8

TABLE A.3. Length frequency of angler-caught pumpkinseeds from Shawano Lake, June 1977 to June 1978.

Length (Inches)	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
4.0-4.9	13	2	10									
5.0-5.9	96	93	121	15					5	10	2	33
6.0-6.9	292	255	265	56	3	11	2	1	17	19	18	277
7.0-7.9	118	76	89	22	2	5	1	1	9	19	12	93
8.0-8.9	5	1	4	1				1		2		1
9.0-9.9	1		1									
Average	6.5	6.5	6.4	6.6	6.9	6.8	6.8	7.5	6.6	6.8	6.8	6.7

TABLE A.4. Length frequency of angler-caught black crapples from Shawano Lake, June 1977 to June 1978.

Length (Inches)	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
4.0-4.9	1							2		2		
5.0-5.9	14	1	2					5		2		1
6.0-6.9	52	10	12	1			3	25	5	9		5
7.0-7.9	142	38	30	9	2	1	2	81	85	253	11	51
8.0-8.9	147	34	25	24	3	4	8	81	230	379	13	86
9.0-9.9	75	25	17	15	1	5	7	63	84	138	6	72
10.0-10.9	27	15	5	3		1	3	34	26	41	1	20
11.0-11.9	17			1	1			3	1	4		1
12.0-12.9	7									2		
Average	8.3	8.4	8.0	8.7	8.8	9.0	8.7	8.5	8.6	8.4	8.4	8.7

TABLE A.5. Length frequency of angler-caught yellow perch from Shawano Lake, June 1977 to June 1978.

Length (Inches)	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
4.0-4.9	24	1	3									
5.0-5.9	108	107	46	9	32	1	3	20	6	9	5	
6.0-6.9	184	195	186	79	129	22	17	45	32	47	13	19
7.0-7.9	103	93	150	84	125	28	4	6	27	53	9	21
8.0-8.9	40	35	40	81	128	28	2		15	41	8	5
9.0-9.9	11	20	9	44	66	10	5	1	8	11	2	2
10.0-10.9	1	1	1	20	21	12	1		3	7	1	2
11.0-11.9					2					1		
12.0-12.9				3					1			
Average	6.6	6.7	7.6	8.0	7.8	8.1	7.3	6.1	6.4	7.6	7.3	7.4

TABLE A.6. Length frequency of angler-caught rock bass from Shawano Lake, June 1977 to June 1978.

Length (Inches)	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
4.0-4.9	6	2										
5.0-5.9	17	28	27	8					1			1
6.0-6.9	49	48	44	47						1	3	18
7.0-7.9	51	33	38	16	1			2		5	2	29
8.0-8.9	12	11	5	7				6		4	2	34
9.0-9.9	5	3	1	2				1			1	3
10.0-10.9	2	3	2	3								1
11.0-11.9	2											
12.0-12.9												1
Average	7.0	6.8	6.8	7.0	7.5			8.4	5.5	7.8	7.6	7.9

TABLE A.7. Length frequency of angler-caught northern pike from Shawano Lake, June 1977 to June 1978.

Length (Inches)	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
10.0-10.9			1									
11.0-11.9		1	1	1								
12.0-12.9		3	6	5			2	3		5	1	1
13.0-13.9	3	7	2	1	1		7	4	3	8		1
14.0-14.9	3	2	12	7	4	1	9	9	7	6	2	13
15.0-15.9	12	6	2	5	1		12	15	7	16		14
16.0-16.9	11	6	8	7	4		19	13	13	25	1	22
17.0-17.9	6	6	7	5	5	6	16	19	25	21	4	20
18.0-18.9	9	10	6	9	10	2	29	21	18	26	5	26
19.0-19.9	11	3	5	9	4	1	15	14	15	10	1	10
20.0-20.9	8	9	7	5	4	3	18	14	11	24	1	9
21.0-21.9	4	3	2	7	2		22	7	9	13	3	7
22.0-22.9	1	3	2	5			15	7	3	6	3	1
23.0-23.9	4	1			3		7	6	6	5	1	2
24.0-24.9		2	1	1	1	1	11	4	2	1	1	
25.0-25.9					1	1	4	3	3	1		
26.0-26.9		1				1	5	1	3	4		
27.0-27.9	1					1	4	3		3		2
28.0-28.9		1	1				4			2		
29.0-29.9	1						1	2	1			
30.0-30.9								1	1	4		
31.0-31.9			1									
32.0-32.9									1			
33.0-33.9								1				
34.0-34.9												
35.0-35.9												
36.0-36.9												
37.0-37.9									1			
Average	18.4	18.1	17.3	17.9	18.7	20.1	19.8	19.1	19.3	18.9	19.2	17.4

TABLE A.8. Length frequency of angler-caught walleyes from Shawano Lake, June 1977 to June 1978.

Length (Inches)	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar*	Apr*	May
9.0-9.9	1	1										
10.0-10.9												1
11.0-11.9												2
12.0-12.9	6	4	3									1
13.0-13.9	5	1	1						1			7
14.0-14.9	5	4	3	1			4					9
15.0-15.9	3	2	2	4	1		2	4				3
16.0-16.9	2	3		2			5	8	3			1
17.0-17.9	2		1	3		3	9	2				4
18.0-18.9	2	1		6	1	2	14	9	3			1
19.0-19.9	1			5			7	2				1
20.0-20.9		1		2			4	1				1
21.0-21.9						2	4	1				
22.0-22.9												
23.0-23.9		1										
24.0-24.9								1				
Average	14.6	15.2	14.3	17.9	17.0	19.2	18.2	17.4	16.9			15.7

\*Season closed.